AGRICULTURAL Research

JANUARY 1955

TESTED TUBERS

Potatoes coming to market labeled according to use—research-gained knowledge points in this way.

• see page 14

BANG'S BUSTER

An important weapon in our stepped-up drive against brucellosis will naturally be Strain 19 vaccine. A Beltsville laboratory is the world culture source.

• see page 8

PALE PLANTS

What causes so-called lime chlorosis? Scientists are looking into the plant and soil differences involved in this complex condition.

• see page 4

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 3—January 1955—No. 7
Joseph F. Silbaugh—Managing Editor

CONTENTS

Birthday

AGRICULTURAL RESEARCH was started 2 years ago this month because many of you had asked for it. And most of you receive this publication every month for the same reason.

Now we're asking for it: What do you think of the result? Is AGRICULTURAL RESEARCH doing a job for *you?*

We began with the encouragement of many groups. These included the Agricultural Research Policy Committee and several advisory committees, which recommended publication of a progress report on USDA research and regulatory work. The Doane Study Group, appointed by the House Committee on Agriculture in 1950, made a similar recommendation.

Our aims haven't changed in these 2 years. We're still trying to give you what's new, what's significant, what's timely, about work that covers the Nation and beyond. We're trying to make these reports concise and understandable. Those aren't easy marks, and we often miss.

Our audience hasn't changed either. Mostly, we reach you who work with farmers, processors, marketing agencies, and the general public—that is, extension workers, vocational agriculture teachers, other Federal and State workers, advisory committees, farm organizations, farm press and radio, and trade associations. Copies also go to Federal and State researchers, research organizations, and members of Congress.

This brings up the matter of distribution. We're sorry we haven't been able to meet all your requests, but there's naturally a limit on the number of free copies we can print. (Anyone can receive this publication, of course, by subscribing for $1 a year through the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

And a reminder on reprinting articles from AGRICULTURAL RESEARCH. An increasing number of publications find it worthwhile to pass on our stories. You are welcome to do so, and in most cases we can supply prints of illustrations.

On this second birthday we acknowledge the help of scientists in USDA, State experiment stations, and cooperators. Without their support and patient assistance, it would be impossible for us to produce AGRICULTURAL RESEARCH.

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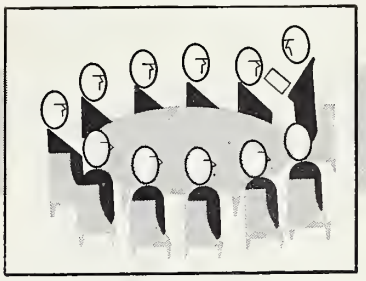
How advisory committees work



AGRICULTURAL LEADERS HELP GUIDE USDA RESEARCH

THE USDA's research and marketing advisory committees, which give regular counsel and guidance to the Department on its research and related work, are now in the midst of their tenth series of meetings since they were first established 8 years ago. (See schedule on p. 16.)

These committees are appointed by the Secretary of Agriculture, under the Research and Marketing Act of 1946. Members represent all sections of the country and all segments of our agricultural economy, from producers to consumers.

Among the committees meeting this year are two new ones recently named by Secretary Ezra Taft Benson. The first will consult with Department specialists on food distribution, the second on research in farm and home equipment and structures. They are *ad hoc* committees, each scheduled for only one meeting.

The others are continuing groups and most of them have been operating since 1947. Eighteen are concerned with particular farm commodities. Five so-called functional committees advise on such matters as production economics, food and nutrition, and transportation—activities affecting a wide range of commodities.

Besides the commodity and functional committees, there is also a national advisory group that's concerned with broader aspects of all Department research and marketing programs. This group is known as the Agricultural Research Policy Committee, or ARPC. This was the first USDA committee to be appointed under the Research and Marketing Act, and its members helped in establishment of the other committees.

The ARPC and 6 of the other advisory groups held meetings during the past 3 months. All but 1 of the remainder, including the 2 *ad hoc* committees, will meet between now and the end of March. The advisory committee concerned with work on dried beans and peas holds sessions biannually and does not have a meeting scheduled this year.

Committee meetings are held in Washington, except that in about 1 year out of 4 each committee convenes at a State experiment station or Federal laboratory or field station to observe the work in progress.

Members, who serve without pay, are chosen for their experience and leadership in fields of work that concern the Nation's agriculture.

Serving for the first time this year on 17 of the permanent committees are 37 new members, appointed this fall by Secretary Benson. It's the general policy of the Department to change about one-fourth of the memberships every 2 years. Most of the committees have 11 members and each group elects its own chairman.

Although these committees advise on all the research and on special aspects of the marketing-service and educational work of various USDA agencies, responsibility for effective operation is assigned to the Agricultural Research Service. This function is performed by a staff of 6 men in the office of the ARS Administrator. Each man serves as executive secretary of 4 or 5 committees, under the leadership of Barnard Joy, assistant to the Administrator for advisory committee operations.

The value of the advisory committees to USDA and to agriculture generally is chiefly that their members—informed persons in daily contact with all aspects of agricultural operations in this country—can keep Government research agencies and workers in closer touch with the needs and problems of agriculture and agricultural industries.

Since the advisory committees began their work, they have taken a hand in the initiation of many new research projects and have greatly influenced the direction and emphasis given to hundreds of continuing projects that were already under way.

One example is the Foundation Seed Project (AGR. RES., Nov. 1953, p. 8), which has done so much to increase the quantities of seed of improved forage crops available to farmers. It's operating successfully today as a result, in large part, of committee recommendations.

The Congress, in making appropriations for agricultural research, gives careful consideration to recommendations of these committees. Recent increases in funds for research on dairy, poultry, and livestock diseases, for example, are attributable in part to the concern expressed by committee members over need for greater effort to solve these problems.

At a recent ARPC meeting, Secretary Benson expressed to members the Department's appreciation for the voluntary work of advisory groups. "We need your counsel and direction," he said. "You know the needs and are in a position to help us develop and formulate programs that insure maximum benefits."☆

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SEVERAL WESTERN calcareous soils, untreated, produced pale, chlorotic soybeans (left); with DTPA chemical added, normal plants.

Plant and soil differences are important factors in

'LIME CHLOROSIS'

SOME PEOPLE consider that lime causes chlorosis of plants grown on calcareous (high lime) soils. But USDA's nutritional studies point to factors associated with lime, rather than lime itself, as the cause.

Chlorosis of plants on western calcareous soils poses one of the most difficult of all nutritional problems to solve. It's due to iron deficiency in the plants caused by their failure to absorb enough iron from the soil or to utilize iron which has been absorbed.

Underlying plant and soil factors remain obscure. However, ARS soil scientists J. C. Brown and R. S. Holmes have shown that adding lime to acid soil won't create the conditions found in naturally-calcareous soil.

Brown and Holmes added radioactive iron, as ferric chloride, to calcareous soils and then demonstrated by radioautographs whether it had been taken into plants growing in those soils. A radioautograph is made by placing X-ray film in contact with the plant in the dark. Radioemanations register as light. A light image means a concentration of radioiron. A faint image means less iron, and chlorosis.

Calcareous soil makes radioactive iron almost wholly unavailable to some plants. Chemical compounds called chelates (kee-lates) combine with the iron in the soil and shield it from other chemicals, making it available to the plant. Soil applications of one chelate, DTPA (diethylenetriamine pentacetic acid), effectively released iron to soybeans on western calcareous soils—more effectively on some soils than on others. These results are encouraging. They may bring a solution of the chlorosis problem under field conditions.

Studies in which the chelate was radioactive have shown that chelate molecules themselves—or their decomposition products—are absorbed by the plant. This shows the chelate is used up in making iron available.

Field and laboratory studies indicate that phosphorus and copper may be causative factors in chlorosis on western calcareous soils.☆

CHLOROSIS ON CALCAREOUS SOIL

It makes a big difference what crops are grown on a calcareous soil. Some, like wheat, do well, corn fairly well, and some soybeans not so well. Plants here grew in a calcareous soil with added radioactive iron. An X-ray film placed against a plant shows light where radioiron was located. Low iron means chlorotic plants.

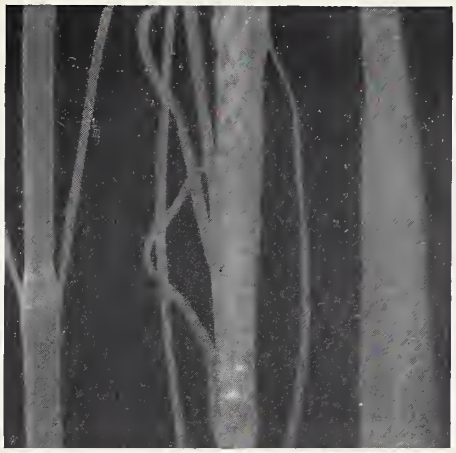
CHELATE CHEMICAL SETS IRON FREE

A soil treatment with chemicals called chelates releases tied-up iron to plants. Plants get more iron from some calcareous soils than from others. Tests aim at a better understanding of the chelate's role in getting iron into plants, which might explain iron tie-up and point to preventive measures or better correctives.

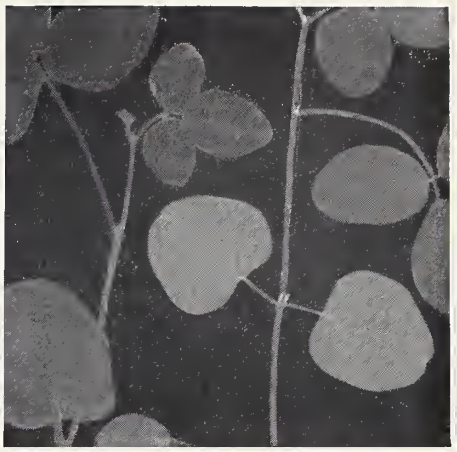
WHERE IRON IS DEPOSITED

There seems to be considerable variation in the way plants distribute the iron they get. They store it in the parts being formed when they get it. If supply is continuous, it's usually well distributed; if interrupted, unevenly distributed. Mineral nutrition of soil influences absorption and translocation of iron in plants.

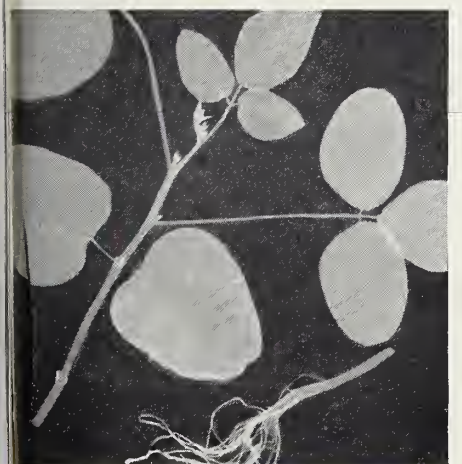
1. Emanations from radioactive iron in a wheat plant appear as light in this radioautograph and show that iron was particularly abundant in heads. This also shows wheat gets the iron it needs from such soil, though plants subject to "lime chlorosis" get little.



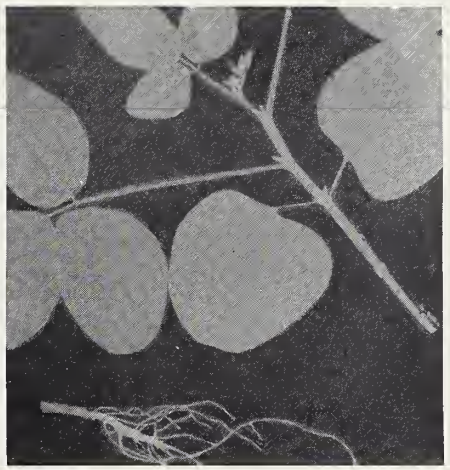
2. Corn plant had pale streaks—was stunted. Radioautograph shows that it got only a fair amount of iron from the calcareous soil. That is the reason for its partial chlorosis. The iron which it picked up is fairly well distributed throughout the plant.



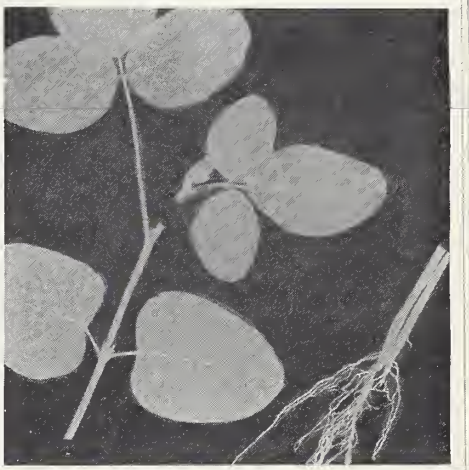
3. These soybeans had radioactive iron in seed. Hawkeye variety (right) was getting iron from soil as well as seed, distributing both throughout the plant. But plant selection PI–54619–5–1 (left) got iron from the seed only—not nearly enough for the entire plant.



4. The chelate known as DTPA caused a highly-calcareous soil from a Palisade, Colo., orchard to supply plenty of iron to this soybean. The chelate has been able to release the iron from the soil and make it available to the plants. Iron was distributed evenly.

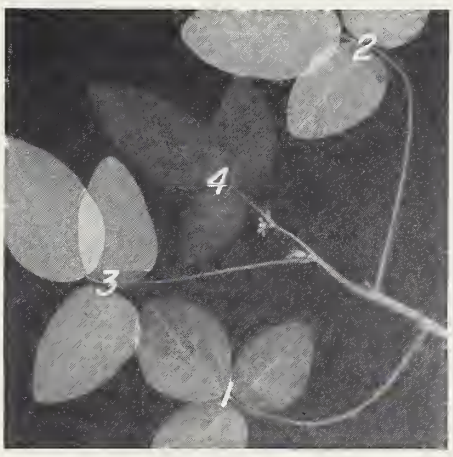


5. The same kind of soybean got much less iron on an equally calcareous soil from Logan, Utah. This indicates that soils of equal lime content don't necessarily release equal amounts of iron—also, that some soil constituents other than lime seem to be involved.

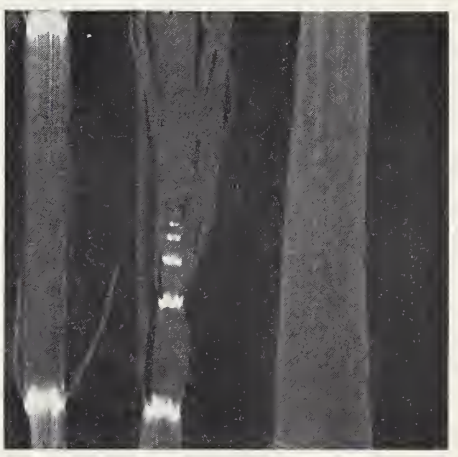


6. This radioautograph shows radioactive *carbon* in a soybean plant. The radiocarbon was part of the chelate added to the soil. It shows that decomposition products of the chelate, or the chelate molecule itself, were absorbed, releasing iron to the plant.

7. Hawkeye soybean was able to get ample iron for normal development from this calcareous soil. The iron was generally distributed throughout the plant, being more concentrated in the more actively growing metabolizing parts—the buds, flowers, and fruits.



8. This soybean got nutrients from a calcareous soil, but had a supplement of radioiron through its stem while the first three trifoliate leaves formed. When the fourth trifoliate started, the supplement was stopped. Iron didn't redistribute to areas of new growth.



9. A deficiency of copper greatly affected this corn's absorption and distribution of iron—caused it to absorb an excessive amount of iron and to store a disproportionate amount of the iron in the nodes. Other plant species studied were not affected in this way.

ALFALFA — animal fats help hold its carotene

Alfalfa growing green in the field abounds in carotene, a pro-vitamin that poultry and other livestock convert into the vitamin A they need for good growth and reproduction. Yet when this alfalfa is cut, made into dry meal, and stored as feed, as much as 50 to 75 percent of the carotene combines with oxygen—and simply disappears.

USDA scientists now believe that the loss of this important nutrient can be cut almost in half, just by treating the alfalfa meal with a fat or oil.

Earlier work with the Colorado experiment station and industry showed that a commercial antioxidant can be used to help alfalfa meal hold its carotene (AGR. RES., June 1954, p. 16). The chemical is applied to dry alfalfa with an oil or fat as a carrier. Little antioxidant—only 0.015 percent—is required, and the carrier amounts to about 1 percent (by weight) of the feed mixture.

But further studies convince the researchers that an animal fat or vegetable oil *alone* can do an equally good job, provided enough is used. Recent tests showed that meal treated with 5 percent of animal fats retained nearly twice as much carotene as untreated meal. Several vegetable oils gave good results, too.

Oiling the dried, chopped alfalfa just before it's made into meal also has other advantages. It keeps down dust in dehydrating plants, lessening fire hazards. Employees can dispense with dust masks and work in greater comfort.

With a choice of carotene savers, dehydrators can take the best market buy. Low-cost animal fats are likely to be most economical, mainly because their use for soapmaking has dwindled. Whether it's more profitable to use 1 percent of fat or oil with an antioxidant, or 5 percent without an antioxidant, is another question. Dehydrators can answer it on the basis of relative cost.

In work by the ARS Western Regional Research Laboratory, test-tube results were checked in a commercial-scale experiment at a dehydrating plant. Melted tallow was metered onto dry, chopped alfalfa as it moved into a hammermill for grinding and mixing.

The resulting meal contained about 5 percent tallow. After 16 weeks storage at 77° F., it still retained 62 percent of the original carotene. Meal with 1.4 percent tallow kept 47 percent of its carotene. But untreated meal was left with only 38 percent.

How does oiling help meal keep its pro-vitamin A? Alfalfa tissues are well supplied with natural antioxidants. Oiling apparently enables these built-in stabilizers to mix more thoroughly with the carotene, thus guarding it more effectively against oxidation.

This view is supported by results of another test, in which 5 percent of mineral oil—an especially good vitamin-A absorber—was added to alfalfa meal. This meal kept 90 percent of its carotene.

The mineral oil, of course, has no nutritional value since it can't be digested. Animal fats and vegetable oils used in the same way are readily digested.☆

TOBACCO — use enough zineb

Farmers who use zineb and tobacco dust to combat tobacco blue mold are likely to get poor results unless they put a lot of zineb in the mixture, say USDA plant pathologists E. E. Clayton and J. J. Grosso.

The fungicide zineb (zinc ethylene bisdithiocarbamate) is widely used against blue mold—a serious disease in every tobacco-growing area in the United States except Wisconsin. In Connecticut and Florida, where blue mold is a field problem, tobacco dust has become popular as a diluent or carrier for zineb. The advantage of tobacco dust in field use is that it leaves less unsightly residue than pyrophyllite or talc, diluents commonly used in seedbed treatments. The whitish residues of these carriers lower the market value of the leaves.

Clayton and Gross found, however, that tobacco dust is much less effective as a carrier than pyrophyllite. In research at Beltsville, Md., they got only 68 percent control over blue mold with a 10-percent mixture of zineb in tobacco dust. This compared with 97 percent control with a 10 percent zineb-pyrophyllite mixture. Increasing the zineb to 20 percent improved control, but it still wasn't as good as 10-percent zineb-pyrophyllite.

These tests emphasize the need for an effective field treatment that won't leave unsightly residues.☆

WILDRYE — yields more seed

Russian wildrye is a perennial grass that would be just the thing for the Northern Great Plains if it didn't have one major fault: poor ability to make seed.

This grass is nutritious, drought-resistant, and palatable over its entire grazing season. But it doesn't produce enough seed to justify widespread planting.

Agronomists, however, hate to give up on such promising material. They've tried selection and breeding for better seed-producing strains, and the results look encouraging. Recently, they've discovered two new leads: heavy nitrogen application and wide-row spacing.

These factors emerged as important in studies by USDA agronomist R. E. Stitt. Working in cooperation with the Montana experiment station, Stitt tested this grass under both irrigation and dryland conditions.

Under irrigation, planted in rows 1½ to 2 feet apart, Russian wildrye gave high seed yields in the year following application of 100 or 200 pounds of nitrogen per acre. Under dryland conditions, wide-row spacing combined with high-nitrogen application got best results. However, unfertilized rows spaced 6, 7, and 10 feet apart gave fairly good yields.

Neither fertilizer nor any other treatment tested assured high seed yields *every* year, and the response to nitrogen was limited to the year after application. But these limited Montana studies have provided some important clues. Experiments there are continuing.☆

CORN ▒ borer parasites busy

Not long after the European corn borer was first discovered in this country near Boston in 1917, USDA entomologists began their search for insect enemies of this pest. By 1940, four different parasites—natives of Europe and Asia—had been established in the East.

Since that time, entomologist K. D. Arbuthnot has kept tabs on these exotic helpers within a 78-square-mile area near Hartford, Conn., to determine just how effective they are. He found that the parasites destroy 1 out of 3 of the first or summer brood of corn borers, and about 1 out of 5 of the fall brood.

Three of the parasites are wasplike. One of these lays its eggs in the eggs of the corn borer; the other two insert their eggs into the small borer larva. The fourth parasite looks much like a house fly; this one deposits live maggots that penetrate nearby borers. Parasite larvae eventually devour their borer hosts.

The researcher found a slight drop-off in the rate of parasitization of the summer-brood corn-borer populations in this eastern area. From 1939 to 1945, parasitization averaged 37 percent; during the next 6 years, 29 percent. On the other hand, parasitization of the fall borer broods has been going up—from 15 percent during the 1939–45 period to 22 percent in recent years.☆

WHEAT ▒ parathion hits mites

Parathion sprays may offer wheat farmers a means of reducing damage to their crop by the brown wheat mite, preliminary research results indicate.

In the past 2 years, entomologists C. F. Henderson of USDA and E. W. Tilton of the Kansas experiment station have tested more than a score of insecticides against this pest on western Kansas wheat farms.

Except for demeton, a systemic chemical, only parathion gave effective control (90 percent or better) for as long as a week to 10 days after application.

Too little is known about demeton to warrant its recommendation now, the researchers say. Two questions about this chemical remain to be answered: (1) What are the safest and most effective ways of applying the material to wheat? (2) As a systemic, does demeton move into the wheat kernel—which is used for food and feed—and if so, how long do such residues remain there?

Meanwhile, parathion appears to be the best insecticide for control in the south-central Great Plains, where the brown wheat mite is often troublesome. The suggested application is a spray at the rate of one-half pound of parathion per acre when the weather is warm (about 55° F.) and there's little wind to drift the spray.

Parathion is highly toxic to man and livestock, so users should handle this material in strict accordance with all the directions of the manufacturer.☆

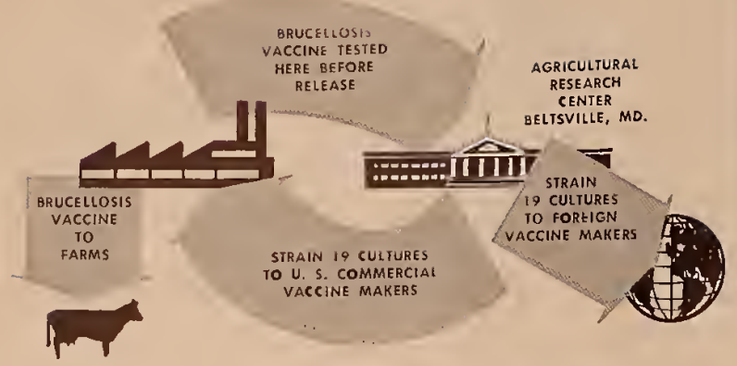
RANGE ▒ responds to fertilizer

Researchers find that a little fertilizer can make the western range green with more grass, golden with more seed, and red with larger herds of beef cattle.

At Guthrie, Okla., beef gains were boosted 58 percent (from 84 to 133 pounds per acre) by fertilizing the native grasses on cleared virgin brushland pasture, and 54 percent (from 52 to 80 pounds per acre) by fertilizing eroded range that had been reseeded to native grasses.

Soil scientists H. A. Daniel of USDA and H. M. Elwell of the Oklahoma experiment station carried out this cooperative experiment at Guthrie. They applied 300 pounds per acre of superphosphate drilled 4 inches deep, once every 3 years, and 33 pounds of nitrogen each May. Hereford steers were used to test gains and grazing capacity on the fertilized and unfertilized range.

Fertilizer increased seed yield 85 percent on the debrushed range plots after the grazing season.☆



Strain 19

vaccine starts here

BELTSVILLE IS THE WORLD CENTER OF THIS BRUCELLOSIS WEAPON

NO CURE is known for brucellosis of cattle (Bang's disease), a most serious infectious disease and one readily transmissible to humans (AGR. RES., Mar.–Apr. 1953, p. 14; Dec. 1954, p. 14).

But at the Agricultural Research Center, Beltsville, Md., a small laboratory supplies the world with cultures of *Brucella abortus* Strain 19 to make a vaccine that protects cattle against the disease.

Strain 19 was developed there in 1930 by USDA scientists J. M. Buck and W. E. Cotton. It was so named because it was derived from the nineteenth in a series of *Brucella* cultures used in the search for a vaccine. A tube of this strain already tested and found virulent was left at room temperature for more than a year. Retested, it had changed to a low stabilized virulence needed in a vaccine.

Now, from Mexico to Pakistan, 30 foreign nations periodically receive fresh cultures. Here in the United States, carefully selected colonies of Strain 19 grown from standardized parent stock go every 3 months to the 20 commercial laboratories licensed to make *Brucella* vaccine. It goes through exacting tests before release.

Important in the control and eradication programs now vigorously carried on against brucellosis, Strain 19 shares in the credit for the progressive reduction of this disease. In 1934, brucellosis affected 11.5 percent of our dairy and beef cattle. But in 1954, only 2.6 percent were affected. Losses in milk and in calves born prematurely have been reduced comparably during the same period.☆

CULTURE SELECTION . . .

Several weeks of culturol selection are sometimes required at the ARS laborotory to get typical growth needed for vaccine. Bacteriologist E. L. Love points out that Strain 19 tends to dissociate into undesirable forms. Any change in medio or variation in chemical reaction of the medium may affect growth. Only experienced workers can detect subtle changes and select suitable colony types. Started in 1940, periodic culture replacement assures uniformity and potency of vaccine.

1 *BRUCELLA ABORTUS* STRAIN 19: (S) typically smooth colonies, and (R) roughly formed growths not suitable for vaccine production. Colonies are carefully selected at ARS laboratory.

2 CULTURES from which new colonies of Strain 19 *Brucella abortus* are grown are stored here at −4° F. Duplicate set of cultures is kept in deep freeze biological repository in California.

3 COLONIES that are typically smooth are selected for transfer from plates to tubes. This is done under a wide-field binocular microscope, as reflected light rays pass through the plate.

4 A culture of Strain 19 is packed in airtight tubes. They are labeled and mailed directly to the vaccine producers. Foreign countries get theirs through their embassies.

VACCINE CONTROL . . .

Every new batch of Strain 19 *Brucella* vaccine produced in this country is put through exacting tests by scientists of the Beltsville, Md., laboratory before the vaccine can be used. If any contaminator or variation from this laboratory standard is found, the entire batch from which the samples were taken is destroyed. Each new lot of vaccine is made up in serials of a minimum quantity of 2,000 to 3,000 doses. Serials of vaccine checked last year indicated production of 6,000,000 doses.

1 VACCINE container of every new batch of Strain 19 *Brucella* is sealed by Federal inspector at commercial plants. Seal remains unbroken, batch isn't released until samples have passed all tests.

2 FIRST STEP in tests for purity is inoculating tubes (one containing broth and the other agarl with vaccine from each sample. Samples from several companies are assembled for test series.

3 PURITY of vaccine is tested by examining growth in test tubes under violet light after incubation period. Top tube shows contamination. Density and pH determinations follow light test.

4 BACTERIAL colonies are counted from samples under a microscope. Freshly prepared vaccine from Strain 19 stock culture must contain not less than 10 billion live bacteria per dose.

Swine parasites: how far yet

WE HAVE A LEAD ON ONE OF THE WORST

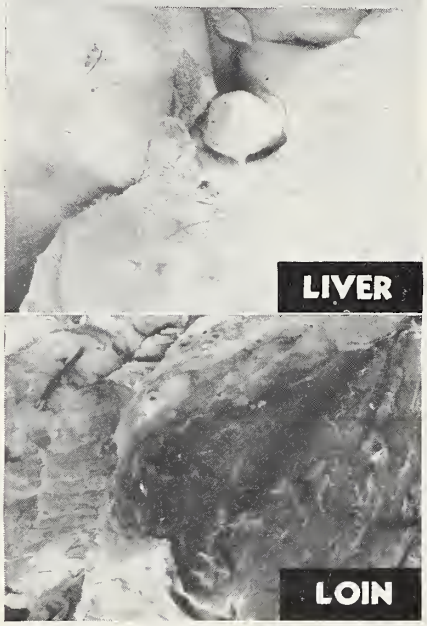
ARE EARTHWORMS a missing link in the life cycle of the swine kidney worm? It's possible, says USDA parasitologist F. G. Tromba, who has recently been exploring this theory at Beltsville, Md.

Experimental earthworms were infected by exposing them to the larvae of kidney worms. Pigs fed the infected earthworms developed kidney worm lesions in the liver. If further research shows that this can happen under field conditions, we may have the answer to a long-time puzzler: How do kidney worms survive their early stages in the soil?

Tromba's work is one of the latest developments in studies by ARS scientists seeking control measures for swine's internal parasites. These attackers cost an estimated $200 million a year. The kidney worm is one of the worst, doing an estimated annual damage of $72,772,000.

Pigs pick up kidney worms by swallowing larvae or simply by lying down on contaminated ground. The pig's body heat stimulates the larvae; they become active and penetrate the pig's skin. These small black-and-white worms burrow extensively in the liver and mature after migrating to the kidney region. Their eggs are discharged from the bladder, and the young worms (larvae) hatch and become infective on the ground.

But the larvae are very sensitive to dryness or low temperatures—factors



KIDNEY WORMS do greatest injury to liver; whitish scars show where damaged cells healed. Expensive parts must be trimmed when loin muscles are infested. Blood vessels, kidneys, and lungs also may be injured.

common in soil. Chances for survival would be much better under unfavorable conditions if the larvae could be picked up by earthworms. (Several internal parasites of swine *require* an intermediate host. The lungworm, for example, needs the earthworm, the liver fluke uses an aquatic snail.)

There is no known medicinal treatment for removal of kidney worms. Nor is there any known medicinal treatment for removal of gullet worms, threadworms, nodular worms, whipworms, trichinae, thorn-headed worms, or three species of lungworms.

This does not mean the problem has been neglected. Parasitologist A. O. Foster points to successful development of treatment of the large roundworm (sodium fluoride), three types of stomachworms (carbon disulfide, sodium fluoride), four types of nodular worms (phenothiazine).

Some injurious parasites that can now be controlled by medication have also been well controlled indirectly: Pigs are fed milk, skimmed milk, or whey exclusively for three successive days at intervals of 2 weeks, or any one of these milk products daily in place of one grain feeding. This reaction from milk feeding has been peculiar to swine.

So medical treatment has been developed against 8 of the 18 comparatively important species of worm parasites that attack swine. Efforts of the scientists have been directed at the most important worms, not just against the most available.

But some of these parasites lie where medication can't reach them. Destroying them through environmental or indirect chemical attack before they enter the hog may become possible. But this will call for economical new larvicides and ovicides.

Larvicides, for instance, have been suggested for chemical control of kidney worms. Promising work has been done with certain borates.

Earlier procedures for lungworms involved direct administration of a chemical (gas, liquid, powder) through the windpipe. But scientists conclude that this treatment, often inducing pneumonia, is more dangerous than the lungworm infection.

Where do we stand in this search? About half way along. Development of the sodium-fluoride treatment for the large roundworm in 1945 was the most important step taken up to that time in chemical control of a leading worm parasite of swine. We can now control 8 of 18.☆

NEW DEVELOPMENTS IN BROODING CHICKS

These two devices have many advantages

TWO RESEARCH-DEVISED innovations for brooding chicks look good in tests by USDA and State experiment station scientists.

One of these developments is a radiant-heating system that's making a hit with Connecticut broiler producers giving it a try. This automatic oil-fired device was developed by agricultural engineer W. A. Junnila of ARS and researchers J. D. Winn, W. A. Aho, and W. C. Wheeler of the University of Connecticut.

The system is proving that it can handle the normal chick complement in a standard (for that State) brooding house—with a minimum of fuel and labor. During trials in uninsulated broiler houses at Storrs experiment station last winter, temperatures dropped to −10° F. The new system brooded 40 chicks for every foot of radiant duct, at a fuel cost of 1.5 to 2.3 cents per chick.

Another brooding method pioneered by ARS engineers—use of infrared heat lamps—is fast catching on in many areas. An answer to the temperature-control problem with infrared brooding has recently been provided by an automatic proportional-temperature-control system. This was worked out by agricultural engineer J. G. Taylor in cooperation with the Purdue experiment station.

Here's the problem: infrared lamps give radiant heat—direct to the chick—and only incidentally warm the brooder air. But the amount of radiant heat needed to keep chicks comfortable depends, of course, on air temperature. Since conventional thermostats aren't designed to sense radiant energy, they are usually put outside a lamp brooder. Thus, their action is based on the air temperature. Unfortunately, such a thermostat can satisfy chick comfort under just two conditions—at high temperatures when all lamps are off, and at low temperatures when all lamps are on. At in-between air temperatures, which is the normal condition, chicks are either too hot or too cold.

The proportional-temperature system solves this problem—and saves electric power in doing it—by operating the heat lamps *intermittently* at all but extremely high or low temperatures. For example, the lamps would be off at an air temperature of 94 degrees; on 10 seconds and off 50 seconds at 84 degrees; on 30 and off 30 seconds at 64 degrees; on 45 and off 15 seconds at 49 degrees; and on continuously at 34 degrees. The off-on ratio can be altered to provide the right amount of heat, depending on the location, number, and wattage of the lamps.

Plastic hovers for infrared brooders are currently being investigated. These transparent hovers apparently save considerable heat but don't interfere with one of the desirable features of infrared brooders—chicks under the hover are always visible.

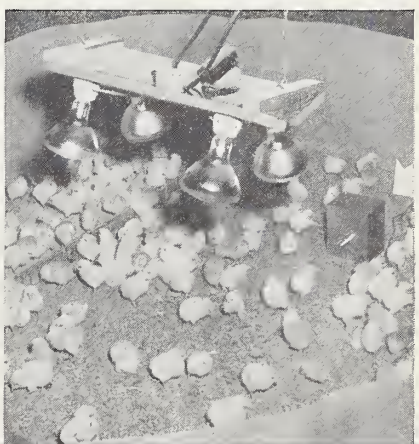
Since the effectiveness and labor-saving advantages of infrared lamps were proved in 1949, researchers have gone ahead to find out what kinds of lamps work best under different brooding conditions and how these lamps should be used. This information is to appear in a new leaflet.☆

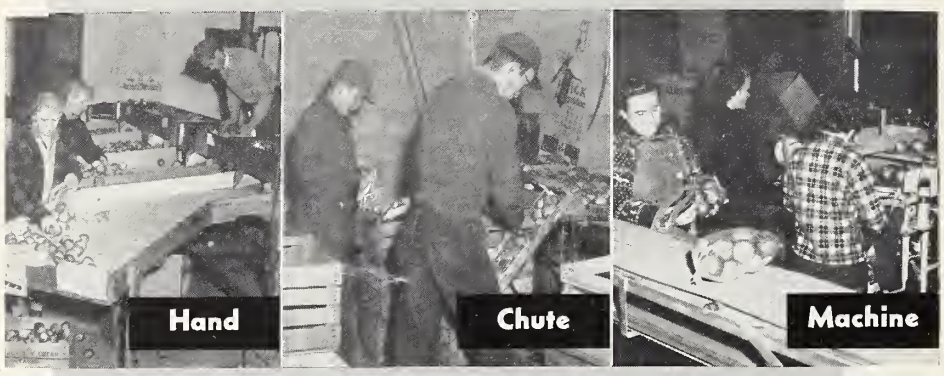
RADIANT-HEAT SYSTEM

Hot air circulated through these ducts gives radiant heat for chicks under hover. Triangular shape has more surface, gives more heat. Heated air is blown through bottom duct and moves back to furnace through top duct to be reheated and recirculated. The system is closed, avoiding danger of drawing dust into furnace. Automatically controlled oil furnace is located in small wing isolated from the house. Installed along north wall, such a unit can provide enough heat for a 2-story building 48 feet wide, up to 350 feet long.

PROPORTIONAL CONTROLLER

Outside direct infrared radiation, controller (arrow) is actuated by air temperature: Off-center cam turns at 1 or more r. p. m.; riding on cam is roller that raises and lowers lamp switch. Thermostat, under switch, has plunger that moves out with warm temperatures, in with cold. When cold, there is no contact between switch and plunger; switch stays open, lamps burn continuously. As air warms, plunger moves out and makes contact for increasing period of each up-and-down cycle of switch. Contact opens switch, turns off lamps.





APPLE BAGGING METHODS: Hand filling—requires only a small investment in equipment. Chute filling—apples are fed into bags by a trough, or chute. Machine filling—belts carry apples to chutes, scales automatically stop flow when bag is filled to the proper weight.

Farm-packed apples in see-through bags

MAKING THE OPERATION MORE EFFICIENT

APPLE GROWERS in Michigan are packing their own apples for market—in plastic-film bags that hold 3 to 5 pounds. Last season they used more than 7 million of these bags, and their on-the-farm pack of apples for this year will undoubtedly be much bigger.

Most Michigan orchardmen now using film bags maintain refrigerated storage on their farms and also conduct apple grading and other packing operations. But smaller growers, especially those with roadside stands, may find film bags profitable too.

Consumers like this transparent film bag because it's handy and they can see *all* the apples.

Retailers find the bags easy to handle at checkout counters as well as helpful in making attractive displays. Small packs encourage customers to buy different varieties of apples at the same time—for pies, sauce, baking, salads, or eating raw.

Producers find that film bagging offers a new and effective method of marketing their apple crop.

USDA agricultural engineer J. H. Levin and Michigan experiment station horticulturist H. P. Gaston last year studied bagging operations on 16 Michigan farms. These packed 90 percent of the State's apples film-bagged on farms.

The researchers found wide variation in the cost of bagging facilities, number of employees, output, efficiency, and other factors. The study showed, however, that labor and equipment costs ran less than 1 cent a bag in an efficient operation.

Plants surveyed used three basic bagging methods—hand, chute, and machine. These methods, with efficient layouts and experienced operators, compared as follows: In hand-filling, a crew of 5 can fill, weigh, and pack into master shipping cartons 450 to 480 bags per hour, or 90 to 96 per employee. With chute filling, 5 workers can increase this rate to 500 bags, or 100 per employee per hour. Using the machine-filling method, a crew of 4 can handle 480 bags of apples per hour, or 120 per employee.

One farm plant with machines had an equipment investment of $500 per worker, highest of the group. Average daily output was 8,650 bags—or 100 every 6.9 minutes. Labor cost per 100 bags was 93 cents.

Another plant—this one used the hand-filling method—had only $18 per worker invested in equipment. But this plant had the highest average daily production—600 bags, or 100 every 6.3 minutes. Labor cost per 100 bags was 94 cents.

The plant with the lowest labor cost per 100 bags—84 cents—used chute filling. It had an equipment investment of $260 per worker and an average output of 4,800 bags in a 10 hour day. Combined cost of labor and equipment was $1.06 per 100 bags packed for a 25-day packing season, 95 cents for a 50-day season, and 91 cents for a 100-day season.

These examples are among the more efficient of the 16 operations. Labor and equipment cost per 100 bags ran as high as $3.04 for a 50-day season. Levin and Gaston concluded that many operators weren't properly equipped or weren't using their equipment to advantage.

The researchers believe that use of suitable varieties, careful grading, and proper supervision of workers are essential for successful filmbag prepackaging. Consumers expect good quality and uniform product, free of blemishes, when they buy prepackaged apples.☆

NUTRITION TEACHING

rounds the globe

EYE-CATCHING—and eye-opening—are posters such as those now being devised round the world to apply research findings to varied food supplies and eating customs.

Americans familiar with the evolution of USDA food plans for good nutrition and the Basic–7 food groups in our National Food Guide can see that this country's research and nutrition education have sparked concepts in foreign visuals.

Perhaps the most striking development in nutrition education today is its rapid spread through many parts of the globe. Channels for interchange of know-how on nutrition have been opened by two-way arrangements between the United States and other countries, as well as through the work of United Nations agencies.

Even hard-to-reach population groups—non-readers, the tradition-bound, groups isolated by dialects—are catching the idea of using food more knowingly to better their lot.

These posters are among nutrition-education materials gathered by ARS from many lands. Nutritionists overseas are also teaching with leaflets, coloring books, comic books, film strips, and motion pictures.

Assembled by food specialist Sadye Adelson, the samples help nutritionists going abroad and those at home who exchange information—and have idea-generating value, besides.☆

USA Basic-7 wheel, simple guide to daily eating, is known to millions. Other countries are using similar plan to convey nutrition message: Japan—version of Basic-7 wheel; Puerto Rico—4 groups of protective foods; New Zealand—saving vitamins and minerals; Dutch—milk, "The healthiest summer drink, It tastes good, It's thrifty"; Haiti—"Eat fruits often"; New Guinea — foods for babies.

1 Specific gravity of this solution is 1.080. The test solutions ranged from low of 1.065 to high of 1.105. Floater tubers were eliminated at each level.

Taking guesswork out of potato buying

VARIETY, REGION, YEAR, STORAGE—ALL MAY MAKE A DIFFERENCE IN QUALITY.

POTATOES of the future may come to market in lots that are labeled to help buyers select tubers best suited to intended uses, such as baking, boiling, frying, or chipping.

Research is now laying a foundation for this more exact marketing, as a new advance in usefulness for the world's number-one vegetable.

An intensive study on raw-potato composition in relation to the eating quality of baked, boiled, and mashed potatoes is the latest groundwork addition. It was made by human nutrition and marketing-research scientists of USDA. The same research team is shaping up a report on its finished experiments on potatoes for french frying. Considerable guidance on the right potatoes for chipping has come from recent Federal and State research (AGR. RES., July 1953, p. 10).

To study this country's potatoes for baking, boiling, and mashing, the scientists collected sample lots from late potatoes of 6 leading commercial varieties, grown in 2 different crop years. These tubers came from States that produce over two-thirds of the late crop.

Samples included Chippewa from Indiana, Maine, Michigan; Green Mountain from 2 Maine locations and New York; Irish Cobbler from Maine, North Dakota, Wisconsin; Katahdin from Colorado, Maine, Pennsylvania; Russet Burbank from Washington and irrigated and non-irrigated land in Idaho; Triumph from 2 North Dakota locations.

It's easy to see from the findings why a shopper can't tell, just by looking, whether a market lot of potatoes will prove mealy, as potato eaters generally prefer tubers to be for baking and boiling. Mealiness may differ, not only with variety, but in the same variety grown in different locations and in succeeding crop years. Thus, Katahdins from Pennsylvania were rated low in mealiness, those from Colorado, high.

2 Thermocouple in one potato in each cooking lot measures temperature as control for doneness—one phase of laboratory-precise cookery.

Green Mountains of the first crop year sampled were more mealy than those of the second. High in mealiness both years were Katahdins from Colorado and Russet Burbanks from Idaho and Washington.

Storage brings changes in texture, too. The longer potatoes were stored, the less mealy and more soggy the judges found them. On the other hand, storage at low temperature (40° F.) lessened sloughing in potatoes that had a tendency to come apart when boiled whole.

Potatoes from only a few test lots sloughed too badly to serve as whole boiled potatoes. Palatability judges rated these satisfactory for serving mashed, and they had high baking quality. Least sloughing was found in Chippewa from all locations and both crop years, Katahdin from Maine and Pennsylvania of both years, and Green Mountain from Maine and Triumph from North Dakota of the first year.

Cooking methods didn't affect the mealiness or the dryness of the potatoes, according to ARS food specialist Mary E. Kirkpatrick, who conducted the cooking and palatability research. A potato that was dry and mealy when boiled was dry and mealy when mashed or baked.

For some years, specific gravity has been known as a predictor of boiling and baking quality in potatoes. In biological-science laboratories of Agricultural Marketing Service, plant physiologist P. H. Heinze recently analyzed raw potatoes for 11 constituents to learn whether better predictors than specific gravity could be found.

Heinze reports that high values for three constituents—dry matter, alcohol insoluble solids, and starch—are all good indicators of the qualities potato eaters prize. But specific gravity is equally good and has the added advantage of being the simplest practical test to use.

Potatoes of higher specific gravity—heavier for their size—require more salt in solution to float them. In the experiments, solutions of 13 progressive densities were used. Average specific gravity for the sample lots ranged from 1.065 (water equals 1) for Katahdin from Pennsylvania to 1.105 for Russet Burbank from Washington.

In marketing, lots could be broken into two or more specific gravity levels when tubers are washed prior to grading and packaging.☆

3 **Sloughing and color are rated under daylight lamps. Trained as judges, laboratory workers take time out from regular duties to rate potatoes on a number of qualities. Realistic wax models provide standards to use in judging real potatoes on sloughing.**

Readers' REACTIONS

Sorry, if—

SIR: Our coworkers are offended when they see in print articles which leave false impressions as to the originators of new ideas in research.

Up to the end of the first three paragraphs of "How Much Is Used" [Oct. 1954, p. 14], one unfamiliar with the subject matter is led to believe E. A. Kane and W. C. Jacobson originated the chromogen technique. It is well known among animal nutritionists that the chromogen technique was first suggested by J. T. Reed of Cornell University.

Reading further, we find that the measurement of pheophytin was the contribution of Kane and Jacobson, a significant improvement in the chromogen technique appreciated by workers in the field.—R. J. GARBER, Director, Regional Pasture Research Laboratory, State College, Pa.

● We hope that this misunderstanding of the first part of our story wasn't shared by other readers. For the information of those who are still using the *original* chromogen technique, Kane and Jacobson and other researchers found that it gave them errors of as much as 30 percent. Study of these test results led to development of the pheophytin method, in which the margin of error is much lower. Further improvements seem likely.—ED.

A reason?

SIR: You report in an editorial [Sept. 1954, p. 2] the desperate need the Nation has for research men in a number of agricultural and allied fields.

Despite their important discoveries, some essential to happy, healthy living for the Nation, there are precious few researchers who are rewarded financially for their efforts. It is the rare research man who can set aside enough money to guarantee his children an education equal to his, while attempting to maintain home and family in decent surroundings. His reward won is only the pride he has in his accomplishments.—HERBERT SHEAR, D. V. M., Inspector, Meat Inspection Branch, ARS, Hartford, Conn.

● Some may agree—or disagree.—ED.

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agrisearch notes

MOST EGGS WEAR a delicate, unnoticed oil coat when they come to market from cold storage. They've been dipped in colorless, tasteless mineral oil, which partly closes shell pores to keep moisture in. This helps hold market quality in storage. Does it have advantages for good eating?

USDA-sponsored tests at State College of Washington showed that if eggs are to be oiled, this is best done the day they are laid. They stand up higher when poached and make lighter, more tender angel-food cake than eggs oiled a week after laying or left untreated. Oil treatment is of no value in maintaining flavor. (In actual practice, many eggs are oiled when about 7 days old, after they reach assembly plants to be packed for storage.)

The researchers who shared in these experiments were home economists Barbara McLaren and Vivian Harns and poultry scientists W. J. Stadelman and E. A. Sauter.

MINERAL OIL AND PARATHION, both indispensable to California citrus growers, can be even more valuable when combined into a single orchard spray. USDA entomologists at Whittier, Calif., found these treatments most effective:

Against California red scale on lemon and orange trees—1 gallon of oil and 1 pound of 25-percent parathion per 100 gallons of spray. Against citrus red mite—1.8 gallons of oil and ½ pound of 25-percent parathion per 100 gallons.

For insect control, these recommendations are clear-cut. But both can cause injury—leaf and fruit drop and (on oranges) twig dieback—especially if trees are under stress of hot, dry weather. Neither should be used on navel oranges.

Seeking a safer spray, entomologists find that lighter-than-normal oil offers a promising lead. But growers are cautioned to try light oil-parathion spray on a small scale, *first*, until more information is available. Light oils now appear to last as long as heavier oils and are less dangerous to trees.

BLACKEYED PEAS grown for commercial canning in the Lower Rio Grande Valley of Texas can be saved from their cowpea-aphid enemies by the use of lindane—and recent experiments indicate that it doesn't damage their flavor.

An off-flavor results in some circumstances and with some foods when potent organic insecticides, such as lindane and benzene hexachloride, are employed.

Plots of blackeyed peas were dusted with lindane and BHC. Representing cooperating agencies in these tests were entomologist G. P. Wene, Texas experiment station; F. P. Griffiths, ARS chemist; and G. W. Otey, crop-production manager.

Samples of treated and untreated peas were rated for flavor by a judging panel at Rutgers University, under the direction of food technologist W. S. MacLinn. Use of lindane didn't result in an objectionable flavor carryover, but peas from plots given single or triple applications of BHC had a detectable off taste.

RESEARCH AND MARKETING advisory committees of USDA are now holding their tenth series of meetings (see full story on page 3). Committees that met during the past 3 months include: Wool (October 25–27, at Denver); Food and Nutrition (November 8–10); Forest Research (November 17–19, at Madison; Production Economics (December 6–8); Dairy (December 13–15); and Rice (December 13–15, at New Orleans).

Schedule of remaining meetings: JANUARY—Seed, 5–7; Soils, Water, and Fertilizer, 5–7; Livestock, 10–12; Deciduous Fruit and Tree Nut, 17–20; Oilseeds and Peanut, 24–26; Grain, 26–28 (Peoria). FEBRUARY—Tobacco, 2–4; Vegetable, 7–11; Cold Storage, 14–16; Poultry, 14–16; Sugar, 23–25; Feed and Forage, 28–2 March; Potato, 28–4 March (Florida). MARCH—Farm and Home Equipment and Structures, 7–9; Cotton and Cottonseed, 14–16; Transportation 16–18; Citrus Fruit, 21–23; Food Distribution, 23–25.

U. S. GOVERNMENT PRINTING OFFICE: 1955